Attachment 7

Stormwater Flood Management Grant Proposal
City of Palmdale
Flood Damage Reduction Costs and Benefits

Attachment 7 consists of the following items:

- ✓ **Flood Damage Reduction Costs and Benefits.** Attachment 7 contains detailed information regarding the tasks that were and will be performed for the proposed project.

Introduction

This attachment provides information regarding the flood damage reduction costs and benefits that will be derived from the Amargosa Project. Narrative descriptions of the expected flood protection benefits of the project are presented in this attachment. Quantitative analyses are provided to monetize the benefits in present value terms (2009). Additionally, descriptions of the economic factors that may affect or qualify the amount of economic benefits to be realized are presented.

The Amargosa Project will reduce the risk of flood damage in three ways:

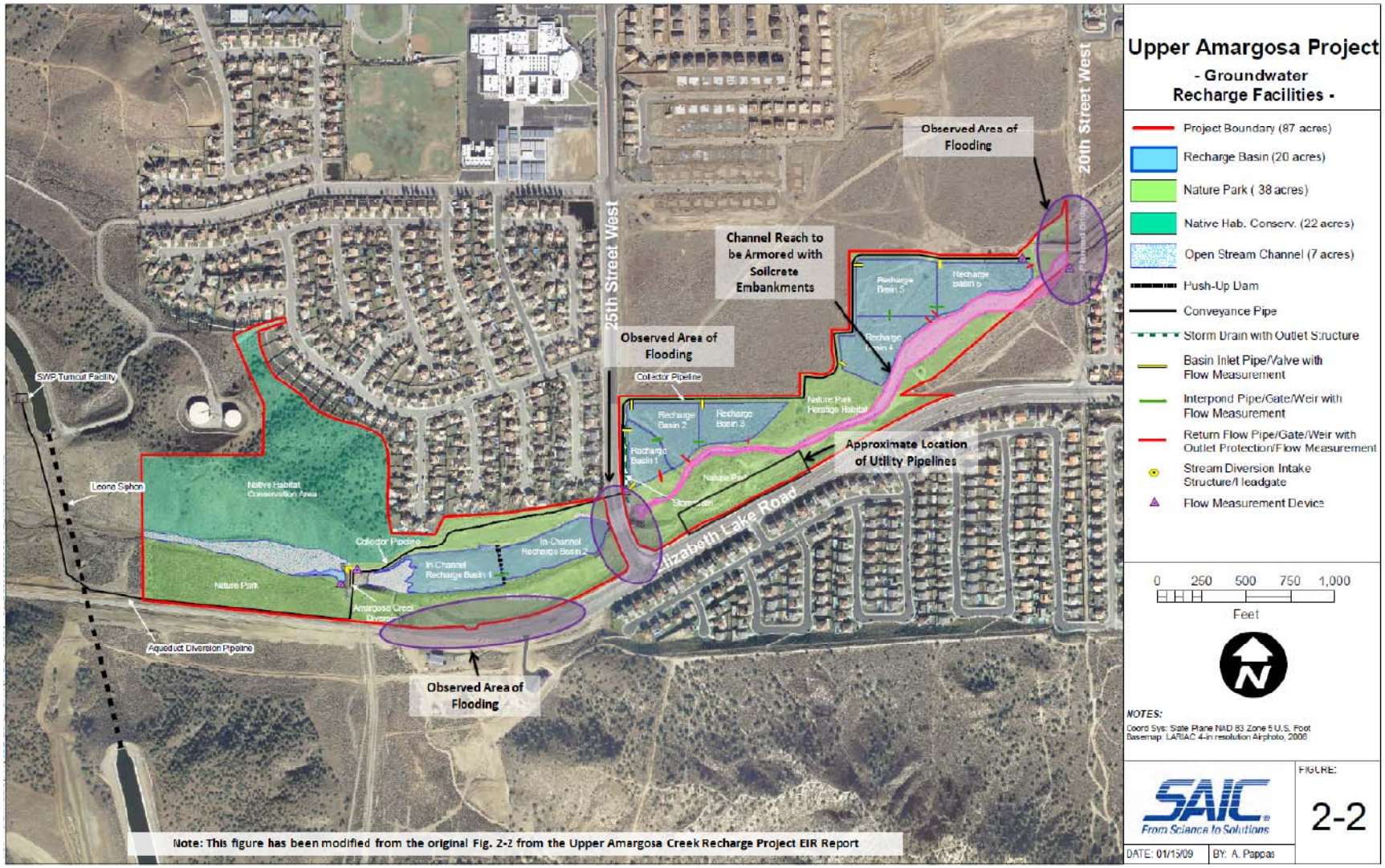
- Protection from erosion damage
- Protection from nearby street flooding
- Removal of public safety hazard

The project reduces the risk of damage from erosion by providing soilcrete embankments between 25th Street West and 20th Street West to protect the channel sides, where washouts and exposure of utility pipes has occurred in the past. The soilcrete embankments also reduce the risk of street flooding in the immediate vicinity by increasing the flow capacity of this same reach of Amargosa Creek (25th Street West to 20th Street West), facilitating the movement of storm flows downstream of 20th Street West and reducing the risk of flooding on Elizabeth Lake Road, 25th Street West, and 20th Street West. Some portion of the flood protection capacity will also be provided by the recharge facilities themselves, which can divert a maximum of 100 cubic feet per second (cfs) to the recharge basins during a storm event. Flows in Amargosa Creek can reach peaks of 2,350 cfs during a 100-year storm event.[1] Finally, the project will provide a public safety benefit from eliminating the natural channel that has formed between the culvert on 25th Street West and Amargosa Creek, an area where pedestrians frequently travel, including school children from Highland High School, Cottonwood Elementary School, Summerwind Elementary School, Juniper Middle School, and Ocotillo Elementary School.

An overview of the Amargosa Project and its flood protection benefits is shown in Figure 7-1.

[1] Water Resources Evaluation of Amargosa Creek, City of Palmdale, July 2009.

Figure 7-1: Amargosa Project Flood Protection Benefits



Project Costs

The total estimated budget for the proposed project is $13,483,322 (see Attachment 4). Administration, Operations and Maintenance costs are anticipated throughout the project lifetime in order to maintain the proposed project. Table 7-1 shows the breakdown of the project costs and its net present value in 2009 dollars.

Table 7-1: Total Project Costs

Phase	Cost
Capital Costs	$13,483,322
O&M and Replacement Costs	$12,455,000
Total project costs	$25,938,322
Total present value of discounted costs ($2009)	$14,463,689

Flood Damage Reduction Costs and Benefits

This Project would provide several flood damage reduction benefits. These benefits are described in detail below and are summarized at the end of the section in Table 7-3.

Avoided Physical Damage

The Amargosa Project reduces the risk of damage from erosion by providing soilcrete embankments between 25th Street West and 20th Street West along the channel sides. Channelization is the process of lining a natural water course to increase flood capacity during storm events, frequently by creating embankments that reduce hydraulic roughness and flow irregularities. The soilcrete embankments proposed for this project are intended to increase flood capacity in this manner.

Soil-cement, or soilcrete, is classified as a chemical stabilization of soil. It is used to improve the bearing capacity, prevent erosion, and/or decrease the permeability of the existing soil. The material normally consists of soil, Portland cement, and water which are uniformly mixed, compacted, finished, and cured in such a manner that the in-place soil-cement mixture forms a dense, uniform mass conforming to the lines, grades, and cross sections of an existing channel. Soils that contain less than 35 percent clay, such as the soils found along the Amargosa Creek, are normally adaptable to this method of stabilization. The cement rate of application ranges from 6 to 12 percent by volume, depending on soil type.

As soilcrete is placed and compacted, the cement hydrates and the mix becomes a structural slab-like material. After curing, it is un-affected by water or by seasonal freeze/thaw cycles.

The City has already constructed soilcrete embankments further downstream in Amargosa Creek between Avenue P and Avenue O-4, as shown in Figure 7-2. Since installation in 2003, these existing soilcrete embankments have effectively prevented erosion in the reaches of Amargosa Creek where they are installed, according to City of Palmdale staff.[2]

[2] Personal communication, Gordon Phair, City of Palmdale, Utilities Service Manager, April 2011

Figure 7-2: Existing Soilcrete Embankments in Amargosa Creek at Avenue O-4 (facing south)

The proposed locations of the soilcrete embankments for the Amargosa Project are shown in Figure 7-1 above. Soilcrete provides protection from erosion in the channel embankments and will prevent the exposure of utility pipes from washouts during storm events.

Protection of Buried Utilities from Erosion

There are three types of buried utilities in the vicinity of the project:

- *Water* - A 24-inch diameter potable water pipe located along the north side of Elizabeth Lake Road in the vicinity of the project; this pipe is owned by Los Angeles County Waterworks District No. 40, Region 34
- *Natural gas* - An 8-inch diameter high-pressure natural gas main located along the north side of Elizabeth Lake Road in the vicinity of the project; this pipe is owned by Southern California Gas Company
- *Sewer* - A sewer trunk line that crosses Amargosa Creek in the vicinity of the project; the trunk line is a 27-inch diameter pipe on the east side of the project and a 30-inch diameter pipe on the west side; the trunk line is owned by Los Angeles County Sanitation Districts

The approximate utility locations are shown above in Figure 7-1.

Buried utilities along Amargosa Creek in this area have already been exposed from storm-induced erosion events in the past. The most recent occurred in early March 2011 when water and gas pipelines were exposed by a storm event, requiring $110,103 in repair costs. The pipelines were exposed at a junction point where sidestream flows entered Amargosa Creek from the south. The exposed pipelines are shown below in Figure 7-3 (the 24-inch water pipe is shown in the background and the 8-inch high-pressure gas line is shown in the foreground).

Figure 7-3: Exposed Gas and Water Pipelines from March 2011 Storm Event

According to City of Palmdale staff, erosion from sidestream flows and from flows in Amargosa Creek occurs during rainfall events every winter in the vicinity of the project. Pipeline exposures similar to the one that occurred in March 2011 are expected to happen approximately every ten years along this reach of Amargosa Creek between 25th Street West and 20th Street West.[3] This analysis assumes that soilcrete embankments will effectively prevent erosion for the 50-year project lifecycle and that utility pipelines will not be exposed or require repair. The analysis also assumes that utility pipelines would continue to require repair approximately every ten years without the project.

Using a repair cost of approximately $110,000 (based on the March 2011 event) and escalating the costs at an assumed inflation rate of 3 percent per year, the total present value of the utility protection benefit is $299,205, as calculated in Table 7-9 at the end of this attachment.

Protection of Streets and Roadways from Flooding

The soilcrete embankments proposed by the Amargosa Project will also provide additional flow capacity for the creek between 25th Street West and 20th Street West, effectively moving more stormwater flows past this reach because of reduced hydraulic roughness and reduced flow irregularities in the channel.

The following sections establish the bases for avoided damages from flooding of streets and roadways in the vicinity of the project.

Frequent Storm Events

Flooding has been observed to occur at the following intervals along nearby streets and roadways according to City of Palmdale staff[4]:

- *Elizabeth Lake Road* – flooding occurs approximately once every five years along a length of approximately 0.1 miles

[3] Personal communication, Gordon Phair, City of Palmdale, Utilities Service Manager. April 2011

[4] Personal communication, Gordon Phair, City of Palmdale, Utilities Service Manager, April 2011

- *25th Street West* – flooding occurs approximately once every year along a length of approximately 0.1 miles, and approximately once every five years along a length of approximately 0.2 miles
- *20th Street West* – flooding occurs approximately once every year along a length of approximately 0.1 miles, and approximately once every five years along a length of approximately 0.2 miles

100-Year Storm Events

Flooding for a 100-year storm event is also projected to cause flooding along these three streets according to the Federal Emergency Management Agency (FEMA) flood inundation maps provided at Floodsmart.gov.[5] As shown in Appendix C, a 100-year storm event is projected to cause flooding along the following lengths of streets and roadways:

- *Elizabeth Lake Road* – approximately 0.5 miles
- *25th Street West* – approximately 0.1 miles
- *20th Street West* – approximately 0.1 miles

These flood events are based on FEMA projections and not on actual, observed events.

This analysis assumes that the soilcrete embankments, and a partial reduction in peak storm flows provided by 100 cfs of diversion capacity, will effectively prevent flooding from a 100-year storm on these three streets for the 50-year project lifecycle. The analysis also assumes that flooding would continue to occur on these three streets if the project is not implemented.

Table 7-2 shows a detailed breakdown of the road inundation assumptions by flooding event.

Table 7-2: Calculation of Avoided Costs of Road/Street Flooding

Road	Miles Inundated	Category	Unit Cost ($/mile inundated)[1]	Total Cost
Once Every Year Flood Event				
Elizabeth Lake Road	0.0	Major Road	$100,000	$0
25th Street West	0.1	Minor Road	$30,000	$3,000
20th Street West	0.1	Unsealed Road	$10,000	$1,000
Five-Year Flood Event				
Elizabeth Lake Road	0.1	Major Road	$100,000	$10,000
25th Street West	0.2	Minor Road	$30,000	$6,000
20th Street West	0.2	Unsealed Road	$10,000	$2,000
100-Year Flood Event				
Elizabeth Lake Road	0.5	Major Road	$100,000	$50,000
25th Street West	0.1	Minor Road	$30,000	$3,000
20th Street West	0.1	Unsealed Road	$10,000	$1,000

1. Cost per mile based on assumptions in DWR's FRAM model
2. Present value of $318,784 is calculated using DWR's FRAM model

Using the Flood Rapid Assessment Model (FRAM) model, the total present value of avoided costs from preventing street flooding is $318,784. Detailed calculations from the FRAM model are shown in Appendix D.

[5] http://www.floodsmart.gov/floodsmart/

Table 7-3: Flood Damage Reduction Benefits Summary

Type of Benefit	Assessment Level	Beneficiaries
Protection of Buried Utilities from Erosion	Quantitative	Local
Protection of Streets and Roadways from Flooding	Quantitative	Local

Summary Distribution of Project Benefits and Identification of Beneficiaries

Table 7-4 summarizes the Project's beneficiaries. Local residents and water customers will benefit from flood protection, increased local supplies, more sustainable management of water supplies, protected quality of groundwater in drinking supplies, enhanced and protected native habitat, increased recreational space, and improved educational opportunities provided in the Nature Park kiosks and signage.

Though the City of Palmdale is not an urban water supplier, the City supports this project as beneficial to the Antelope Valley Region. The regional beneficiaries include other municipalities, communities, water districts, and mutual water companies in the general area. These entities will benefit from reduced groundwater overdraft, avoided dry-year reserve water costs, avoided decline of drinking water supply quality due to arsenic contamination from the lower aquifer, enhanced and protected riparian habitat, and increased education opportunities.

The State of California will benefit from reduced stress on the Bay-Delta during dry years.

Table 7-4: Project Beneficiaries Summary

Benefits	Local*	Regional**	Statewide***
Protection of Buried Utilities from Erosion	✓		
Protection of Streets and Roadways from Flooding	✓		
Protection of Public Safety	✓		
Reduced Groundwater Overdraft	✓	✓	
Avoided Dry-Year Reserve Water Costs	✓	✓	
Avoided Decline of Drinking Water Supply Quality due to Arsenic	✓	✓	
Riparian Habitat Protection and Enhancement	✓	✓	
Increased Water Conservation Education with New Nature Park	✓	✓	
Reduced Stress on Bay-Delta During Dry Years/Seasons			✓

* Includes: City of Palmdale

** Includes: Los Angeles County Water Works District #40, City of Lancaster, Quartz Hill, Rosamond, Antelope Acres, and other surrounding communities

*** Includes: State of California

Project Benefits Timeline Description

The Amargosa Project will provide benefits over an assumed 50-year project lifetime. Benefits from the project will begin accruing as soon as the recharge facilities are constructed in 2013. For additional detail on the timeline for project benefits, see Attachment 5.

Qualitative Benefits Summary

This project will result in a flood benefit, protection to public safety, which could not be quantified. Table 7-5 lists the benefit and gives a qualitative indicator of the likely impact on the overall net benefit from the project.

Table 7-5: Qualitative Benefits Summary

Benefit	Qualitative Indicator
Protection of Public Safety	+

**Direction and magnitude of effects on net benefits

+	Likely to increase net benefits relative to quantified estimates
++	Likely to increase net benefits significantly
"-"	Likely to decrease net benefits
"--"	Likely to decrease net benefits significantly
+/-	Uncertain

Uncertainty of Benefits

Uncertainties relating to the flood reduction benefits of this project are summarized below in Table 7-6. Uncertainties include the inherent unpredictability of rainfall patterns, fluctuations in the availability of imported water, variability in repair frequency for erosion damages, and uncertainty in the regulatory process.

Table 7-6: Uncertainty of Benefits

Benefit or cost category	Likely impact on net benefits	Comment
Protection of Buried Utilities from Erosion	+/-	The uncertainty inherent in this project could have a net positive or negative impact on the benefits. Rainfall/SWP availability could be more or less than predicted. Erosion damages could occur more or less frequently than predicted. Regulatory requirements could evolve in such manner as to be more difficult or more streamlined.
Protection of Streets and Roadways from Flooding	+/-	The uncertainty inherent in this project could have a net positive or negative impact on the benefits. Rainfall/SWP availability could be more or less than predicted. Erosion damages could occur more or less frequently than predicted. Regulatory requirements could evolve in such manner as to be more difficult or more streamlined.

**Direction and magnitude of effects on net benefits

+	Likely to increase net benefits relative to quantified estimates
++	Likely to increase net benefits significantly
"-"	Likely to decrease net benefits
"--"	Likely to decrease net benefits significantly
+/-	Uncertain

Potential Adverse Effects from the Project

Any potential short-term impacts, such as potential harmful effects of removing land from the floodplain, associated with project construction will be mitigated as described in the EIR, in Appendix B. No long-term adverse effects are expected as a result of the proposed project.

Project Benefit Costs Comparison

The total present value of the Project costs, along with monetized and qualitative benefits is provided in Table 7-7.

Table 7-7: Benefit-Cost Analysis Overview

	Present Value ($2009)
Costs – Total Capital and O&M	**$13,483,322**
Monetizable Benefits	
Protection of Buried Utilities from Erosion	$299,205
Protection of Streets and Roadways from Flooding	$318,784
Total Benefits	**$617,989**
Qualitative Benefits	**Qualitative Indicator***
None	-
Total Benefits	
None	**$0**

**Direction and magnitude of effects on net benefits

+	Likely to increase net benefits relative to quantified estimates
++	Likely to increase net benefits significantly
"-"	Likely to decrease net benefits
"--"	Likely to decrease net benefits significantly
+/-	Uncertain

Economic Benefit Tables

Capital costs for the project amount to $14,463,689 in present value terms, as shown in Table 7-8. This includes initial spending starting in 2011 and continuing through 2060. The project lifetime is expected to be 50 years, and annual maintenance costs of $265,000 per year are anticipated once the project is completed, beginning in 2014 to conduct routine maintenance and cleaning operations.

Table 7-8: Amargosa Project Annual Costs

Upper Amargosa Creek Flood Control, Recharge, and Habitat Restoration Project

Year	Initial Costs	Operations and Maintenance Costs						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Grand Total Cost	Admin.	Ops.	Maint.	Repl.	Other	Total Costs (a) +…+ (f)	Disc. Factor	Discounted Costs (g) x (h)
2009	$0	$0	$0	$0	-	-	$0	1.00	$0
2010	$0	$0	$0	$0	-	-	$0	0.94	$0
2011	$1,747,708	$0	$0	$0	-	-	$1,747,708	0.89	$1,555,454
2012	$7,160,723	$0	$0	$0	-	-	$7,160,723	0.84	$6,012,281
2013	$4,574,891	$0	$0	$0	-	-	$4,574,891	0.79	$3,623,742
2014	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.75	$198,023

Table 7-8: Amargosa Project Annual Costs

Upper Amargosa Creek Flood Control, Recharge, and Habitat Restoration Project

Year	Initial Costs	Operations and Maintenance Costs						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Grand Total Cost	Admin.	Ops.	Maint.	Repl.	Other	Total Costs (a) +…+ (f)	Disc. Factor	Discounted Costs (g) x (h)
2015	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.70	$186,815
2016	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.67	$176,240
2017	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.63	$166,264
2018	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.59	$156,853
2019	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.56	$147,975
2020	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.53	$139,599
2021	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.50	$131,697
2022	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.47	$124,242
2023	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.44	$117,210
2024	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.42	$110,575
2025	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.39	$104,316
2026	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.37	$98,412
2027	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.35	$92,841
2028	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.33	$87,586
2029	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.31	$82,628
2030	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.29	$77,951
2031	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.28	$73,539
2032	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.26	$69,376
2033	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.25	$65,449
2034	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.23	$61,745
2035	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.22	$58,250
2036	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.21	$54,953
2037	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.20	$51,842
2038	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.18	$48,908
2039	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.17	$46,139
2040	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.16	$43,528
2041	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.15	$41,064
2042	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.15	$38,739
2043	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.14	$36,547
2044	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.13	$34,478
2045	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.12	$32,526
2046	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.12	$30,685
2047	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.11	$28,948
2048	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.10	$27,310
2049	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.10	$25,764
2050	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.09	$24,306
2051	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.09	$22,930

Table 7-8: Amargosa Project Annual Costs

Upper Amargosa Creek Flood Control, Recharge, and Habitat Restoration Project

Year	Initial Costs	Operations and Maintenance Costs						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Grand Total Cost	Admin.	Ops.	Maint.	Repl.	Other	Total Costs (a) +…+ (f)	Disc. Factor	Discounted Costs (g) x (h)
2052	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.08	$21,632
2053	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.08	$20,407
2054	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.07	$19,252
2055	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.07	$18,163
2056	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.06	$17,134
2057	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.06	$16,165
2058	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.06	$15,250
2059	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.05	$14,386
2060	$0	$53,000	$106,000	$106,000	-	-	$265,000	0.05	$13,572
Totals	**$13,483,322**	**$2,491,000**	**$4,982,000**	**$4,982,000**	**-**	**-**	**$25,938,322**	**-**	**$14,463,689**
Total Present Value of Discounted Costs (Sum of Column (i)) Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries									**$14,463,689**

Comments:
All costs are in 2009 dollars.

Table 7-9: Flood Control Benefits: Protection of Buried Utilities from Erosion Only

Upper Amargosa Creek Flood Control, Recharge, and Habitat Restoration Project

Year	*Discounting Calculations for Economic Benefits*		
	(h)Total Annual Benefits	(i) Discount Value	(j) Discounted Benefits [h x i]
2009	$0	1.000	$0
2010	$0	0.943	$0
2011	$110,000	0.890	$97,900
2012	$0	0.840	$0
2013	$0	0.792	$0
2014	$0	0.747	$0
2015	$0	0.705	$0
2016	$0	0.665	$0
2017	$0	0.627	$0
2018	$0	0.592	$0
2019	$0	0.558	$0
2020	$0	0.527	$0
2021	$147,831	0.497	$73,472
2022	$0	0.469	$0
2023	$0	0.442	$0
2024	$0	0.417	$0
2025	$0	0.390	$0
2026	$0	0.371	$0

Year	*Discounting Calculations for Economic Benefits*		
	(h)Total Annual Benefits	**(i) Discount Value**	**(j) Discounted Benefits [h x i]**
2027	$0	0.350	$0
2028	$0	0.331	$0
2029	$0	0.312	$0
2030	$0	0.294	$0
2031	$198,672	0.278	$55,231
2032	$0	0.262	$0
2033	$0	0.247	$0
2034	$0	0.233	$0
2035	$0	0.220	$0
2036	$0	0.207	$0
2037	$0	0.196	$0
2038	$0	0.185	$0
2039	$0	0.174	$0
2040	$0	0.164	$0
2041	$266,999	0.155	$41,385
2042	$0	0.146	$0
2043	$0	0.138	$0
2044	$0	0.130	$0
2045	$0	0.123	$0
2046	$0	0.116	$0
2047	$0	0.109	$0
2048	$0	0.103	$0
2049	$0	0.097	$0
2050	$0	0.092	$0
2051	$358,824	0.087	$31,218
2052	$0	0.082	$0
2053	$0	0.077	$0
2054	$0	0.073	$0
2055	$0	0.069	$0
2056	$0	0.065	$0
2057	$0	0.061	$0
2058	$0	0.058	$0
2059	$0	0.054	$0
2060	$0	0.051	$0
Total	**$1,082,326**		**$299,205**
Total Present Value of Discounted Benefits over Project Life (Monetized Benefits):			**$299,205**
Project Allocation			**100%**
Total Present Value of Discounted Benefits (Monetized Benefits):			**$299,205**

Comments:
All costs are in 2009 dollars. Used repair cost of $110,000 (based on the March 2011 event) and escalated costs at an assumed inflation rate of 3 percent per year.

Table 7-10: Present Value of Flood Control Benefits from Amargosa Project

Upper Amargosa Creek Flood Control, Recharge, and Habitat Restoration Project

(a)	Present value of erosion benefits	$299,205
(b)	Present value of street flooding benefits	$318,784
(e)	**Total**	**$617,989**

Comments:
(1) Table was modified for the Amargosa Project from DWR Table 12 of the PSP SWFM Guidelines
(2) All values are in 2009 dollars.
(3) 6% discount rate